

ARCS PROCEDURE:	RESET - SMET VERIFICATION PROCEDURE	PRO(SMET)-002.003
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RESET - SMET Verification Procedure

I. Purpose:

This document describes the RESET visit sensor verification and maintenance procedures for the SMET datalogger (DAQS), the Optical Rain Gauge (ORG), the T/RH probe and Aspirated Radiation Shield (T/RH), and the steps needed to check the digital barometer (BAR). Make these checks at approximately six (6) month intervals.

II. Cautions and Hazards:

1. Do not remove test connector while power is applied to the ORG sensor or attempt to operate sensor with the test connector removed.
2. Do not open the sensor on the ORG.
3. Positioning the insulating container in a shaded location improves readings.

III. Requirements:

1. Laptop computer with terminal emulation.
2. Insulated box or ice chest.
3. Lint-free lens cleaning tissues.
4. Lens cleaning solution.
5. Optics brush.
6. Insecticidal strip.
7. HMI31/HMP34 Digital Temperature and Relative Humidity Meter and Probe.
8. Wind Direction Vane Angle Fixture.
9. Anemometer Motor Drive.
10. Vaisala PA11A Digital Barometer.
11. Notebook PC with RS232/EIA422/Impulse adapter.

IV. Procedure:

Replace any nonfunctioning sensor, following the appropriate sensor procedure, before continuing with the rest of this procedure. Also ensure that the datalogger has a good ground. If the ground is interrupted even momentarily while during checking, restart the datalogger by cycling the power OFF and ON again to ensure a good A/D auto-zero.

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A. Cleaning ORG Sensor Lens:

Note: If excessive dirt or dust is built up on the sensor, use the optics brush first to try and remove any particles that may scratch the lens.

1. Apply 1 to 2 drops of the lens solution to a lint-free lens cleaning tissue.
2. Wipe the lens surface in a circular direction.

B. Removing Webs or Nests from ORG:

1. Check underside of sensor hood for nests or web building; remove them if present.
2. If this problem repeats, apply an insecticidal strip to the under side of hood.
3. Replace this strip whenever sensor lens is cleaned.

C. ORG Rain Gauge Verification Check:

1. Place rain cup near optical rain gauge in a nonsheltered location during rain.
2. Record optical rain gauge output.
3. After about 10 mm of rain collects in rain cup, compare optical rain gauge difference with amount collected in cup.
4. If difference is less than 20%, log difference and stop.
5. Otherwise, contact mentor and replace instrument if necessary.

D. Check Aspirated Radiation Shield for Corrosion:

Note: Inspect the wiring connections to the Aspirated Radiation Shield motor periodically for corrosion. RESET can perform this unless it is needed more frequently.

1. Unscrew the two black plastic knurled nuts on the back of the blower cover.
2. Tip the blower cover down and inspect the wiring connections for signs of corrosion.
3. Clean or replace as needed.
4. Return the blower cover to operating position and re-tighten the nuts.

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E. Temperature and Relative Humidity Verification Check:

Note: Check the Vaisala HMP35A Relative Humidity and Temperature Probe by comparison with the Vaisala HMI31/HMP35 Relative Humidity and Temperature Meter.

1. Place insulated box in shaded location.
2. Remove the probe to be checked from the radiation shield.
3. Remove the protective filter from the probe.
4. Put the reference probe and the check probe into the insulated box.
5. Connect the notebook computer to the SMET datalogger using the RS232/EIA422/Impulse adapter and turn ON the adapter power.
6. Establish communications with the datalogger by entering "U."
7. Enable Real-Time Output by proceeding to the System Functions Menu and entering "C4/1." Quit to view the temperature.

Note: If the box is placed in the sun, the temperature drifts slowly upward and RH drifts slowly downward.

8. Observe temperature readings until the readings stabilize (within +/- 0.2 C); record the SMET and reference temperature readings.
9. If the difference between the reference and probe temperature is greater than 0.5°C, the probe is in need of replacement; refer to **PRO(TRH)-005** when replacing the probe.
10. From the Users Menu (enter "U") proceed to the Test Menu and select Scaled to observe relative humidity readings. Wait until the RH readings stabilize (within +/- 0.5% RH). Record the SMET and reference relative humidity readings
11. If the relative humidity reported by the probe differs from the reference by more than +/- 3% RH for values below 90% or +/- 4% RH for RH values above 90%, the replace probe. Refer to **PRO(TRH)-005** when replacing the probe. Also perform a check on the new probe.
12. Return the probe to the aspirator shield following all checks or, if further RH calibrations are required, refer to **PRO(TRH)-003** to calibrate the probes.
13. Disable Real-Time Output by proceeding to the System Functions Menu and entering C4/0.

F. BAR Verification Check:

Note: Check the Vaisala PTB201 digital barometer by comparison with the Vaisala PA11A Digital Barometer.

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1. If not already connected, connect a notebook PC to the SMET datalogger using the RS232/EIA422/Impulse adapter.
2. Turn on the PA11A Digital Barometer.
3. Select Poll Vaisala Barometer from the ZENO Test Menu.
4. Record the pressure readings from the two barometers.
5. If the reading differ by more than +/- 1 millibar, replace the SMET datalogger following procedure PRO(DAQS)-003. Alternately, the digital barometer can be removed from one SMET data logger and installed into another. No procedure currently exists to cover the latter.

G. Wind Monitor Verification Check:

Note: Check the Wind Monitors by using the Vane Angle Fixture and the Motor Drive.

1. Verify the proper operation of the wind direction sensors.
2. Observe the orientation of the anemometers on the tower.
3. If not already connected, connect a notebook PC to the SMET data logger using the RS232/EIA422/Impulse adapter.
4. View the SMET wind directions by selecting Scaled data from the ZENO Test Menu. Compare data logger output with compass reading.
5. If the orientations agree with indicated wind direction within ± 5 deg, log the difference and stop.
6. Otherwise, lower tower and check the non-conforming anemometer(s).
 - a. Remove the Wind Monitor and place the Vane Angle Fixture on the orientation ring. (**Important**, do not loosen or adjust lower orientation ring with notch for sensor unless initial orientation to North is incorrect).
 - b. Replace Wind Monitor on the Vane Angle Fixture.
 - c. Engage the indexing pins in the notches and tighten the clamps (also attach holding arm to the fixture).
 - d. If not already connected, connect a notebook PC to the SMET datalogger using the RS232/EIA422/Impulse adapter.
 - e. Step through the ZENO menus ("**U**," "**T**," and "**Scaled**").
 - f. Use the Vane Angle Fixture to position the vane at 30 degree increments (except 360° where there can be a 1 to 5 degree dead Zone).
 - g. The ZENO should report wind directions within ± 5 degrees of the Vane Angle Fixture settings, (If the instrument fails, replace sensor and try again. If it fails again, contact mentor and consider a

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voltage calibration of ZENO Datalogger [refer to **PRO(DAQS)-004**]).

- h. Remove the Wind Monitor and Vane Angle Fixture.
- i. Place the Wind Monitor on the orientation ring and engage the orientation ring indexing pin in the notch at the instrument base.
- j. Tighten the mounting post band clamp.
- k. Record any changes or comments in the site operations log.
7. Verify proper operation of the Wind Monitor wind speed sensors.
8. Remove the propellor and connect the Anemometer Motor Drive to the propellor shaft.
9. Turn on the Motor Drive, set Motor for CW (clockwise), and set the speed to 200 RPM. The ZENO Test Menu Raw Sensor Data should report a 10 Hz signal. (If achieving a steady 200 Hz is difficult, repeat realigning the motor and anemometer shaft and/or moving in or out as necessary).
10. Set the speed to 400 RPM; the ZENO reports a 20 Hz signal.
11. Set the speed to 800 RPM; the ZENO reports a 40 Hz signal.
12. Set the speed to 1600 RPM; the ZENO reports an 80 Hz signal.
13. Set the speed to 3200 RPM; the ZENO reports a 160 Hz signal.
14. If testing Wind Monitor #1 (input connector 3), check the calibration values for Sensor #1 for conversion from Hz to meters/sec.
15. If testing Wind Monitor #2 (input connector 4), check the calibration values for Sensor #3 for conversion from Hz to meters/sec.
16. If the measured values in Hz differ by more than 5%, replace sensor following procedure PRO(WND)-006. If difference is still greater than 5%, contact mentor.
17. Quit to terminate the connection.
18. Disconnect the notebook computer and connect the logger to ADaM.

H. Corrective Actions

If changing a sensor is not made acceptable by any observation, refer to PRO(DAQS)-004 and perform an SMET instrument calibration.

V. References:

1. "Operation and Maintenance Manual for the SCTI ORG-115 Optical Rain Gauge," Scientific Technology, Inc.
2. Hart, R. "Procedure for Using Vaisala HMI31/HMP35 Relative Humidity and Temperature Meter to Perform Six Month Verification Checks of Relative Humidity and Temperature Probes," December 16, 1995.
3. Hart, R. "Procedure for Using Vaisala PA11A Digital Barometer to Perform Six Month Verification Checks of the Barometric Pressure Transducer," 1995.

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4. Hart, R. "Element Operations and Maintenance Development Outline," Argonne National Laboratory," 1995.
5. R.M. Young Company. "Wind System Calibration," 1994.

VI. Attachments:

1. SMET Sensor Configuration Table.
2. SMET Verification Form.

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Attachment 1. SMET SENSOR CONFIGURATION TABLE

When installing or changing the following sensors or instruments, the calibration coefficients need to be written into the appropriate ZENO Sensor Menu. The calibration coefficient for the air temperature sensor is in the ZENO Process Menu. Details on determining and changing this coefficient is discussed in **PRO(T/RH)-005**.

Sensor or Instrument	Designation	Sensor No.	Connector No.
Wind Speed 1	WSPD1	1	3
Wind Direction 1	WDIR1	2	3
Wind Speed 2	WSPD2	3	4
Wind Direction 2	WDIR2	4	4
Relative Humidity	RH	7	2
Optical Rain Gauge	R-RATE	8	1

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Attachment 2. SMET VERIFICATION FORM

SITE		DATE		TIME	
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SENSOR REPLACEMENTS

SENSOR	Replace dY/N?	Old Serial Number	New Serial Number	New Slope	New Offset	CALs entered?
Rain gauge						
T/RH				*	N/A	
Barometer				N/A	N/A	N/A
Wind Monitor 1						
Wind Monitor 2						

*If T/RH replaced, was Process 4 multiplier calibrated?

ORG RAIN GAUGE

Lens cleaned?	
Webs or nests?	
Verified?	

ASPIRATED RADIATION SHIELD

Cleaned?	
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T/RH

SMET T °C	Ref T °C	SMET RH %	Ref RH %

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Replacement T/RH (if applicable)

SMET T °C	Ref T °C	SMET RH %	Ref RH %

SITE		DATE		TIME	
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BAROMETER

SMET	PA11A

WIND MONITOR

Wind Direction

Compass	Wind Monitor #1	Wind Monitor #2

Wind Speed

RPM	Wind Monitor #1	Wind Monitor #2	Expected value
200			10 Hz
400			20 Hz
800			40 Hz
1600			80 Hz
3200			160 Hz

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WIND MONITOR Replacement (if applicable)

Wind Direction

Compass	Wind Monitor #1	Wind Monitor #2

Wind Speed

RPM	Wind Monitor #1	Wind Monitor #2	Expected value
200			10 Hz
400			20 Hz
800			40 Hz
1600			80 Hz
3200			160 Hz